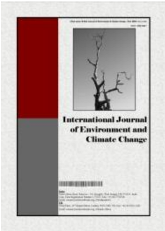

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Dry Matter Production and Nutrient Uptake of Coloured Capsicum Hybrids (*Capsicum annuum var. grossum L.*) as Influenced by Different Irrigation Levels under Shade Net

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: The experiment was aimed at evaluating the influence of different irrigation levels on dry matter production and nutrient uptake of coloured capsicum hybrids.
Study Design: Split plot design with three replications
Place and Duration of Study: Horticultural farm, College of Agriculture, Rajendranagar, Hyderabad during rabi 2018-19.
Methodology: The experiment was laid out in split plot design and the treatments comprises of four irrigation levels *viz.,* drip irrigation at 0.4, 0.6, 0.8 and 1.0 Epan as main treatments and three hybrids *viz.,* Indra (green), Orobelle (yellow), Bomby (red) as sub treatments and replicated thrice. The recommended dose of nutrients were 100:80:60 N, P_2O_5 and K_2O kg ha^{-1} and entire dose of P_2O_5 was applied as basal, N and K_2O was applied through venturi meter as fertigation on three days interval from 9 to 153 DAT. The crop was transplanted at 45 cm × 40 cm spacing in September under a green shade net. Irrigation scheduling was done based on daily evaporation data recorded from USWB class 'A' pan evaporimeter. The cumulative daily evaporation during crop growth period was 737.5 mm. Quantity of water applied including special operations of 26 mm and effective rainfall during crop growth period were 245.3, 392.0, 546.5 and 698.5 mm and 58.6,

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64.2, 74.6, 82.6 mm out of 127.4 mm of rainfall for 100, 80, 60 and 40 per cent irrigation treatments, respectively as per water balance method. Bed size was 7.6 m × 0.9 m.

Results: Significantly higher yield (47.50 t ha^{-1}) was recorded with drip irrigation at 1.0 Epan than rest of the treatments. Indra recorded significantly higher yield (40.27 t ha^{-1}) than other two hybrids. The interaction effect between drip irrigation levels and hybrids was not significant on Dry Matter Production and N, P & K uptakes and economics of capsicum. DMP and nutrient uptake were significantly higher with drip irrigation at 1.0 Epan than 0.8, 0.6 and 0.4 Epan throughout the crop growth over other drip irrigation levels. Among hybrids, Indra recorded significantly higher DMP and nutrient uptake than other two hybrids.

Keywords: Capsicum; drip irrigation; shade net; dry matter production; nutrient uptake.

1. INTRODUCTION

Capsicum is also known as bell pepper or sweet pepper and Shimla mirch which is a cool season tropical crop belongs to the family Solanaceae, and is native of South and Central America. Fruits of Shimla mirch are large (usually bell shaped; hence called bell pepper) and non-pungent (hence also called sweet pepper). The term Shimla mirch originated because probably it was first cultivated in Shimla region (temperate climate), which was suitable for its cultivation. It attained a status of high value crop in India in recent years, occupying an area of 46 thousand hectares, producing 327 thousand metric tons. The major capsicum producing states in India are Himachal Pradesh, Karnataka, Madhya Pradesh, Haryana, Jharkhand, Uttarkhand and Orissa. In Telangana it occupies an area of 0.52 thousand hectares, producing 6.63 thousand tonnes [1].

Capsicum varieties may occur in many shapes and colours. Capsaicin is the main chemical content in sweet pepper. It is rich in carbohydrates, Vitamin A (8493 IU), Vitamin C (283 mg) and minerals like Calcium (13.4 mg), Magnesium (14.9 mg) Phosphorus (28.3 mg) and Potassium, (263.7 mg) per 100 g fresh weight. The mature fruits (green, red and yellow) of sweet pepper are eaten raw or widely used in stuffing's, baking's, pizza, burger preparations, spices and as external medicine. Red bell pepper containS 1.5 times more vitamin C, 8 times more vitamin A and 11 times more beta carotene than green bell peppers. Yellow bell peppers have more vitamin C than green ones, but less vitamin A and beta carotene (Jessy, 2012). The high market price it fetches is attributed to the heavy demand from the urban consumers and for export which needs fruits with longer shelf life, medium size tetra lobed fruits with attractive colour, mild pungency with good taste. However, the supply is inadequate due to the low productivity of the crop [2]. The target can be achieved by bringing additional area under capsicum crop using hybrid seeds, improved agro techniques, perfection and promotion of protected cultivation of vegetables.

Rational use of irrigation water is important for increasing productivity which influences dry matter production (DMP), high nutrient uptake and also save irrigation water, which is costly and a scarce resource. This can be achieved by advanced method of irrigation like micro irrigation systems particularly, drip method which is most efficient coupled with other improved water management practices.

Capsicum under drip irrigation with higher level of irrigation provides excellent results in term of growth and yield [3]. The drip irrigation adoption increases water use efficiency (60-200%), saves water (20-60%), reduces fertilization requirement (20-33%) through fertigation, produces better quality crop and increases yield (7-25%) as compared with conventional irrigation [4]. Thus, we discuss about various treatments using drip irrigation under shade net and treatment producing high dry matter production and nutrient uptake of nutrients.

2. MATERIALS AND METHODS

2.1 Characterization of Experimental Site

The experiment was carried out at Horticultural farm, College of Agriculture, Rajendranagar, Hyderabad in a shade net during *rabi* season, 2018-2019. The farm is geographically situated in the Southern Telangana Zone at 17°19'11" N latitude and 78°24'58" E longitude at an altitude of 542.3 m above mean sea level.

2.2 Treatments, Agronomic Management and Statistical Design

The experiment was conducted in split plot design with 12 treatments and replicated thrice, comprising of four drip irrigation levels *viz.,* drip irrigation at 0.4 Epan, 0.6 Epan, 0.8 Epan, 1.0 Epan as the main treatments and three hybrids *viz.,* Indra (green), Orobelle (yellow), Bomby (red). The recommended dose (RD) of nutrients were 100:80:60 kg N: P_2O_5: K_2O ha^{-1}. The spacing adopted for sowing was 45 cm × 40 cm and transplanted on 2nd September, 2018. Experimental soil was sandy loam in texture, slightly alkaline in reaction (pH=7.8), non-saline (EC=0.31 dS m^{-1}), low in organic carbon (0.2 %), low in available nitrogen (145.51 kg ha^{-1}), medium in available phosphorus (47.15 kg ha^{-1}) and low in available potassium (156.7 kg ha^{-1}). The water source for irrigation was from a bore well. The irrigation water used to the experiment was neutral and categorized under Class II (C2S1). Rainfall of 127.4 mm was received during the entire crop growth period. The mean weekly maximum and minimum temperature ranged from 30.8ºC to 14.4ºC and 19.9ºC to 8.7 ºC respectively.

The entire dose of phosphorus was applied to soil as basal whereas nitrogen and potassium were applied through fertigation at 3 days interval through venturi system. Coloured capsicum hybrids were Indra (green), Orobelle (yellow), Bomby (red). Shade net colour was green with 50% shade and tape type was used. Gross plot size, lateral spacing, emitter spacing and drip discharge rate were 7.6 m x 0.9 m, 0.6 m, 0.4 m and 4 L h^{-1}, respectively. Plants were planted in zig-zag manner on the bed. The three plants used for leaf area index (LAI) were uprooted carefully at 30, 60, 90, 120, 150 and 178 days after transplanting (DAT) and roots were removed from basal portions. The fruits were collected at 1st, 2nd, 3rd, 4th and 5th pickings. Both samples were first air dried in shade for one day and then oven dried at 60^0 C till a constant weight was obtained. The mean dry weight of plant samples and dry fruit samples were expressed as kg ha^{-1}. Uptake of N, P and K was calculated using nutrient concentrations and dry matter yield or fruit yield as expressed by multiplying nutrient content and dry matter divided by 100.

3. RESULTS AND DISCUSSION

3.1 Total Dry Matter Production (kg ha^{-1})

Total DMP at various crop growth DAT was significantly influenced by different drip irrigation levels and hybrids (Table 1 and Fig 1.) and among the different irrigation levels, drip irrigation at 1.0 Epan was significantly higher than 0.6 and 0.4 Epan and was on par with 0.8 Epan (22.8 kg ha^{-1}) and 0.6 Epan (22.6 kg ha^{-1}). Significantly lower DMP was observed with 0.4 Epan than 1.0 Epan and was on par with drip irrigation at 0.6 and 0.8 Epan at 30 DAT.

At 60 DAT, drip irrigation scheduled at 1.0 Epan (195.1 kg ha^{-1}) recorded significantly higher DMP than 0.6 and 0.4 Epan and was on par with drip irrigation at 0.8 Epan (187.4 kg ha^{-1}). Drip irrigation at 0.4 Epan (173.8 kg ha^{-1}) was significantly lower than 0.8 and 1.0 Epan and was on par with drip irrigation at 0.6 Epan. At 90 DAT, 1.0 Epan (687.6 kg ha^{-1}) recorded significantly higher DMP than 0.6 and 0.4 Epan and was on par with drip irrigation at 0.8 Epan (654.0 kg ha^{-1}) and drip irrigation at 0.4 Epan (614.92 kg ha^{-1}) was significantly lower than 0.8 Epan and was on par with drip irrigation at 0.6 Epan in DMP.

At 120 DAT, DMP was realized significantly higher with drip irrigation at 1.0 Epan (1161.6 kg ha^{-1}) than 0.6 and 0.4 Epan and was at par with drip irrigation at 0.8 Epan (1104.5 kg ha^{-1}). Drip irrigation at 0.4 Epan (1053.8 kg ha^{-1}) recorded significantly lower DMP than 0.8 and 1.0 Epan and was on par with drip irrigation at 0.6 Epan (1075.0 kg ha^{-1}). Significantly higher DMP at 150 DAT was observed with drip irrigation at 1.0 Epan (1640.9 kg ha^{-1}) than 0.8 Epan (1527.1 kg ha^{-1}). However, significantly lower DMP recorded with drip irrigation at 0.4 Epan (1510.0 kg ha^{-1}) than 0.8 and 1.0 Epan and was on par with drip irrigation at 0.6 Epan (1377.2 kg ha^{-1}).

Significantly higher DMP was observed at 178 DAT with drip irrigation at 1.0 Epan (2158.7 kg ha^{-1}) than 0.6 and 0.4 Epan and was at par with drip irrigation at 0.8 Epan (2136.3 kg ha^{-1}). Drip irrigation at 0.6 Epan (1975.8 kg ha^{-1}) was significantly lower than drip irrigation with 0.8 Epan and was on par with 0.4 Epan (1894.0 kg ha^{-1}). Increased in DMP was observed due to higher uptake of nutrients (Tables 2, 3 and 4) and moisture from early stage of the crop resulted in better utilization of nitrogen led to higher plant height, leaf area and leaf area index with higher photosynthetic rate for building of organic substances in the plant and these increase in DMP results are in accordance with those of and [5] in capsicum and [6], [7] and [8] in chilli.

Among different hybrids, significantly higher DMP was observed at 30 DAT and 60 DAT with Indra

(25.1 and 189.8 kg ha^{-1}) than Orobelle (22.8 and 181.7 kg ha^{-1}) and Bomby (21.5 and 180.3 kg ha^{-1}). Significantly lower DMP was recorded in Bomby than Indra and was on par with Orobelle. At 90, 120 and 178 DAT, there was significantly higher DMP was observed with Indra (660.68, 1123.7 and 2101.3 kg ha^{-1}) than Bomby and was on par with Orobelle (660.7, 1112.8 and 2076.4 kg ha^{-1}). Significantly lower DMP was observed with Bomby (626.2, 1059.7 and 1945.9 kg ha^{-1}) than rest of the treatments.

At 150 DAT, Indra was observed significantly higher (1618.89 kg ha^{-1}) than Orobelle (1559.7 kg ha^{-1}). Orobelle was observed significantly higher than Bomby (1498.4 kg ha^{-1}). This might be attributed to higher vegetative growth contributing to a greater number of flowers, a greater number of fruits, higher per cent of fruit set and hence higher shoot and fruit DMP. Similar results coincides with the results of [9] and [10].

3.2 Nutrient Uptake

Significant variation in NPK uptake was observed due to different drip irrigation levels and hybrids. However, there was no interaction effect between drip irrigation levels and hybrids on these parameters (Table 2, 3 and 4).

3.2.1 Nitrogen (N) uptake (kg ha^{-1})

At 30 DAT, nitrogen uptake at drip irrigation at 1.0 Epan (0.94 kg ha^{-1}) recorded significantly higher than rest of the treatments. Drip irrigation at 0.6 Epan (0.84 kg ha^{-1}) was on par with drip irrigation at 0.4 Epan. However lower nitrogen uptake was noticed with 0.4 (0.83 kg ha^{-1}) and 0.8 Epan (0.83 kg ha^{-1}) which were on par with each other. At 60, 90 and 178 DAT, drip irrigation at 1.0 Epan observed higher (6.82 kg ha^{-1} and 20.41 kg ha^{-1} and 71.85 kg ha^{-1}) and was on par with 0.8 Epan (6.38 kg ha^{-1} and 21.74 kg ha^{-1} and 71.27 kg ha^{-1}). Drip irrigation at 0.6 Epan (6.08 kg ha^{-1}and 22.95 kg ha^{-1} and 63.45 kg ha^{-1}) which was on par with drip irrigation at 0.4 Epan (5.68 kg ha^{-1}, 23.99 kg ha^{-1} and 59.2 kg ha^{-1}) respectively. Drip irrigation at 0.6 Epan which was on par with 0.8 Epan.

Significantly higher nitrogen uptake at 120 DAT with drip irrigation at 1.0 Epan (41.02 kg ha^{-1}) was recorded than rest of the treatments. Drip irrigation at 0.8 Epan (37.57 kg ha^{-1}) was on par with drip irrigation at 0.6 Epan (36.38 kg ha^{-1}). Drip irrigation at 0.6 Epan was on par with drip irrigation at 0.4 Epan (34.18 kg ha^{-1}).

3.2.2 Phosphorus (P) uptake (kg ha^{-1})

At 30, 60, 90 and 178 DAT, phosphorous uptake at drip irrigation at 1.0 Epan (0.05, 0.37, 1.61 and 3.59 kg ha^{-1}) recorded higher and was on par with drip irrigation at 0.8 Epan (0.05, 0.34, 1.45 and 1.44 kg ha^{-1}). Drip irrigation at 0.6 Epan (0.04, 0.30, 1.33 and 3.03 kg ha^{-1}) was on par with drip irrigation at 0.4 Epan irrigation (0.04, 0.28, 1.25 and 2.71 kg ha^{-1}) respectively. At 120 DAT, drip irrigation at 1.0 Epan (2.78 kg ha^{-1}) recorded significantly higher phosphorus uptake than rest of the treatments. Drip irrigation at 0.8 Epan (2.53 kg ha^{-1}) was on par with 0.6 Epan (2.34 kg ha^{-1}). However lower phosphorus uptake was noticed with 0.4 Epan (2.16 kg ha^{-1}) which was on par with 0.6 Epan.

Among the hybrids, at 30 and 90 DAT, significantly higher phosphorous uptake was recorded with Indra (0.05 and 1.46 kg ha^{-1}) than Bomby and was on par with Orobelle (0.05 and 1.45 kg ha^{-1}). Significantly lower phosphorus uptake was observed with Bomby (0.04 and 1.32 kg ha^{-1}). At 60 DAT, significantly higher phosphorous uptake was recorded with Indra (0.34 kg ha^{-1}) than Bomby and was on par with Orobelle (0.31 kg ha^{-1}). However significantly lower phosphorus uptake was observed with Orobelle than Indra which was on par with bomby (0.31 kg ha^{-1}). At 120 DAT, phosphorus uptake with Indra (2.60 kg ha^{-1}) was recorded significantly higher than Orobelle (2.50 kg ha^{-1}). Significantly lower phosphorus uptake was observed with Bomby (2.26 kg ha^{-1}) than other two hybrids. At 178 DAT, significantly higher phosphorus uptake was observed with Indra (1.32 kg ha^{-1}) than Orobelle and Bomby.

3.2.3 Potassium (K) uptake (kg ha^{-1})

Significantly higher K uptake was recorded at 30, 60, 120 and 178 with drip irrigation at 1.0 Epan (0.33, 2.49, 10.72 and 18.69 kg ha^{-1}) than 0.6 and 0.4 Epan and was on par with 0.8 Epan (0.30, 2.24, 9.55 and 17.61 kg ha^{-1}). At 30 and 120 DAT, significantly lower potassium uptake recorded with 0.4 Epan (0.25 kg ha^{-1} and 4.66 kg ha^{-1}) than 1.0 Epan and was on par with 0.6 (0.27 and 8.42 kg ha^{-1}) and 0.8 Epan (0.30 and 9.55 kg ha^{-1}). At 60 and 178 DAT, significantly lower potassium uptake recorded with 0.4 Epan (1.61 and 12.97 kg ha^{-1}) than 1.0 and 0.8 Epan and was on par with 0.6 Epan (1.84 and 14.55 kg ha^{-1}). At 90 DAT, drip irrigation at 1.0 Epan (7.65 kg ha^{-1}) recorded significantly higher than 0.8 (6.48 kg ha^{-1}), 0.6 (5.22 kg ha^{-1}) and 0.4 Epan (4.68 kg ha^{-1}). Significantly lower potassium uptake was observed with drip irrigation at 0.4 Epan than 0.8 and 1.0 Epan and was on par with 0.6 Epan.

At 60, 90, 120 and 178 DAT, potassium uptake not significantly influenced by hybrids and at 30 DAT, Indra recorded significantly higher potassium uptake than other two hybrids. Significantly lower potassium uptake was recorded with Bomby (0.26 kg ha^{-1}) than Indra (0.32 kg ha^{-1}) and was on par with Orobelle (0.27 kg ha^{-1}).

Table 1. Total dry matter (kg ha^{-1}) of capsicum different days after transplanting as influenced by different drip irrigation levels and varieties under shade net

Treatments	30 DAT	60 DAT	90 DAT	120 DAT	150 DAT	178 DAT
Main – (Irrigation levels):						
I_1: Drip irrigation at 0.4 Epan	22.4	173.8	614.9	1053.9	1510.1	1894.0
I_2: Drip irrigation at 0.6 Epan	22.6	179.4	631.1	1075.0	1527.2	1975.8
I_3: Drip irrigation at 0.8 Epan	22.8	187.4	654.0	1104.6	1558.0	2136.3
I_4: Drip irrigation at 1.0 Epan	24.7	195.1	687.6	1161.7	1640.9	2158.7
SEm ±	0.4	3.0	9.6	14.3	18.8	30.7
C.D (P=0.05)	1.5	10.5	33.3	49.4	64.9	106.4
Sub – (Hybrids):						
V_1 : Indra	25.1	181.7	653.8	1123.8	1618.9	2101.3
V_2 : Orobelle	22.8	189.8	660.7	1112.9	1559.8	2076.4
V_3 : Bomby	21.5	180.3	626.2	1059.7	1498.5	1945.9
SEm ±	0.4	2.6	6.93	9.8	13.6	28.4
C.D (P=0.05)	1.3	7.8	20.7	29.4	40.6	85.1
Interaction:						
Hybrids at same level of irrigation levels:						
SEm ±	0.9	5.2	13.85	19.6	27.1	56.8
C.D (P=0.05)	NS	NS	NS	NS	NS	NS
Irrigation levels at same or different hybrids:						
SEm ±	0.8	5.2	14.85	21.4	29.0	55.6
C.D (P=0.05)	NS	NS	NS	NS	NS	NS

Table 2. Nitrogen uptake (kg ha^{-1}) of capsicum different days after transplanting as influenced by different drip irrigation levels and hybrids under shade net

Treatments	30 DAT	60 DAT	90 DAT	120 DAT	178 DAT
Main – (Irrigation levels):					
I_1: Drip irrigation at 0.4 Epan	0.83	5.68	20.41	34.18	59.20
I_2: Drip irrigation at 0.6 Epan	0.84	6.08	21.74	36.38	63.45
I_3: Drip irrigation at 0.8 Epan	0.83	6.38	22.95	37.57	71.27
I_4: Drip irrigation at 1.0 Epan	0.94	6.82	23.99	41.02	71.85
SEm ±	0.02	0.15	0.46	0.73	2.00
C.D (P=0.05)	0.07	0.50	1.60	2.51	6.90
Sub – (Hybrids):					
V_1 : Indra	0.93	6.25	22.92	27.39	70.49
V_2 : Orobelle	0.85	6.48	22.80	27.98	65.99
V_3 : Bomby	0.80	6.00	21.10	26.6	62.85
SEm ±	0.02	0.12	0.34	1.03	1.90
C.D (P=0.05)	0.05	0.36	1.03	3.09	5.70
Interaction:					
Hybrids at same level of irrigation levels:					
SEm ±	0.03	0.24	0.69	2.06	3.8
C.D (P=0.05)	NS	NS	NS	NS	NS
Irrigation levels at same or different hybrids:					
SEm ±	0.03	0.24	0.73	2.07	3.69
C.D (P=0.05)	NS	NS	NS	NS	NS

Table 3. Phosphorus uptake (kg ha^{-1}) of capsicum different days after transplanting as influenced by different drip irrigation levels and hybrids under shade net

Treatments	30 DAT	60 DAT	90 DAT	120 DAT	178 DAT
Main – (Irrigation levels):					
I_1: Drip irrigation at 0.4 Epan	0.041	0.28	1.25	2.16	3.16
I_2: Drip irrigation at 0.6 Epan	0.042	0.30	1.33	2.34	3.56
I_3: Drip irrigation at 0.8 Epan	0.045	0.34	1.45	2.53	4.18
I_4: Drip irrigation at 1.0 Epan	0.052	0.37	1.61	2.78	4.31
SEm ±	0.002	0.01	0.05	0.07	0.15
C.D (P=0.05)	0.007	0.05	0.16	0.25	0.53
Sub – (Hybrids):					
V_1 : Indra	0.048	0.31	1.46	2.60	4.19
V_2 : Orobelle	0.045	0.34	1.45	2.50	3.79
V_3 : Bomby	0.041	0.31	1.32	2.26	3.41
SEm ±	0.001	0.01	0.03	0.05	0.12
C.D (P=0.05)	0.004	0.03	0.09	0.15	0.36
Interaction:					
Hybrids at same level of irrigation levels:					
SEm ±	0.003	0.02	0.06	0.10	0.24
C.D (P=0.05)	NS	NS	NS	NS	NS
Irrigation levels at same or different hybrids:					
SEm ±	0.003	0.02	0.07	0.11	0.25
C.D (P=0.05)	NS	NS	NS	NS	NS

Table 4. Potassium uptake (kg ha^{-1}) of capsicum different days after transplanting as influenced by different drip irrigation levels and hybrids under shade net

Treatments	30 DAT	60 DAT	90 DAT	120 DAT	178 DAT
Main – (Irrigation levels):					
I_1: Drip irrigation at 0.4 Epan	0.25	1.61	4.68	7.67	12.97
I_2: Drip irrigation at 0.6 Epan	0.27	1.84	5.22	8.42	14.55
I_3: Drip irrigation at 0.8 Epan	0.30	2.24	6.48	9.55	17.61
I_4: Drip irrigation at 1.0 Epan	0.33	2.49	7.65	10.72	18.69
SEm ±	0.01	0.14	0.30	0.65	1.04
C.D (P=0.05)	0.05	0.47	1.05	2.23	3.60
Sub – (Hybrids):					
V_1 : Indra	0.32	2.08	5.87	9.52	16.97
V_2 : Orobelle	0.27	2.07	6.15	9.00	15.75
V_3 : Bomby	0.26	2.00	6.01	8.75	15.15
SEm ±	0.01	0.07	0.32	0.35	0.64
C.D (P=0.05)	0.02	NS	NS	NS	NS
Interaction:					
Hybrids at same level of irrigation levels:					
SEm ±	0.02	0.14	0.63	0.69	1.28
C.D (P=0.05)	NS	NS	NS	NS	NS
Irrigation levels at same or different hybrids:					
SEm ±	0.02	0.18	0.60	0.86	1.47
C.D (P=0.05)	NS	NS	NS	NS	NS

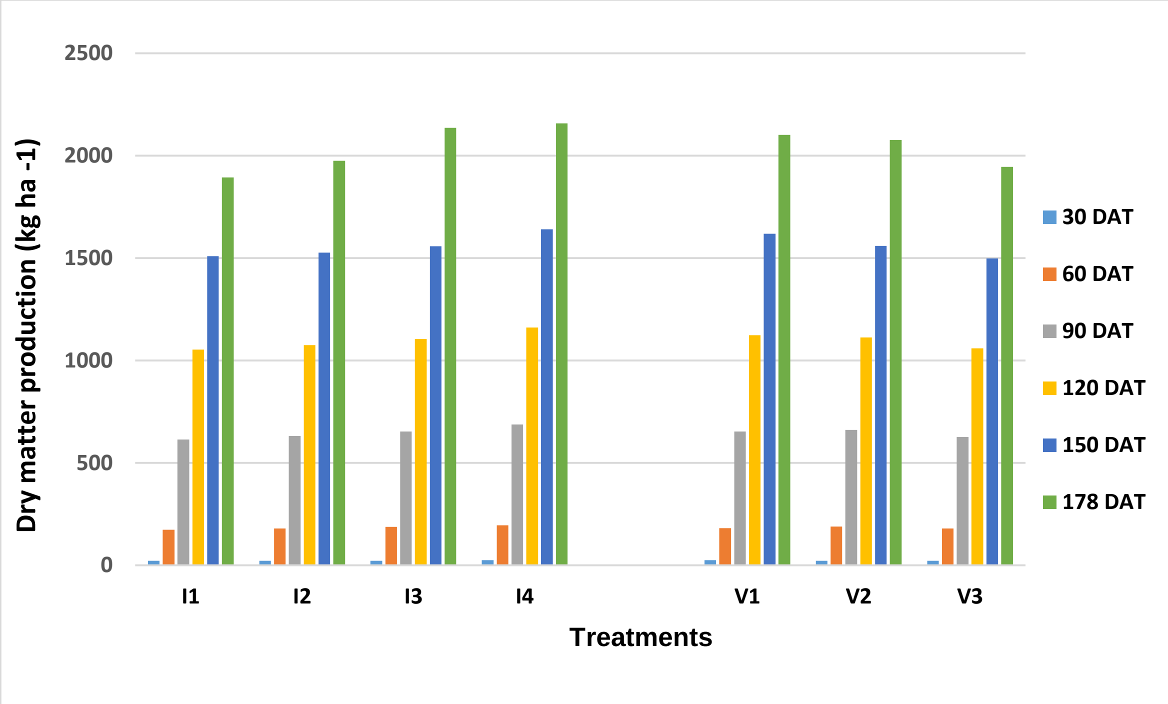

Fig. 1. Total dry matter (kg ha^{-1}) of capsicum at different days after transplanting as influenced by different drip irrigation levels and variables under shade net

4. CONCLUSION

Drip irrigation at 1.0 Epan recorded significantly higher DMP at 30, 90, 120 and 150 DAT than rest of the treatments. Indra recorded significantly higher DMP at 30, 90, 150 and 178 DAT. At 60 and 120 DAT, Orobelle recorded significantly higher DMP than Bomby and was on par with Indra at 120 DAT. Among the drip irrigation levels, 1.0 Epan and 0.4 Epan recorded significantly higher and lower uptakes of N, P and K throughout the crop growth than other drip irrigation levels. Indra (green) recorded significantly higher NPK uptake throughout the crop growth period than Bomby (red) and on par with Orobelle (yellow).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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